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10/014,418	12/14/2001	Katsumi Nakagawa	35.C16024	9769

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EXAMINER

SONG, MATTHEW J

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 05/02/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/014,418	Applicant(s) NAKAGAWA ET AL.	
	Examiner Matthew J Song	Art Unit 1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on _____.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-52 is/are pending in the application.
- 4a) Of the above claim(s) 12-25 and 38-51 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-11, 26-37 and 52 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) <u>5</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:

I. Claims 1-11, 26-37 and 52, drawn to a process, classified in class 117, subclass 54.

II. Claims 12-25 and 38-51, drawn to an apparatus, classified in class 117, subclass 200.

2. The inventions are distinct, each from the other because of the following reasons:

Inventions I and II are related as process and apparatus for its practice. The inventions are distinct if it can be shown that either: (1) the process as claimed can be practiced by another materially different apparatus or by hand, or (2) the apparatus as claimed can be used to practice another and materially different process. (MPEP § 806.05(e)). In this case the apparatus as claimed can be used in another and materially different method, such as one where the crucible is not rotated independently from the substrate.

3. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

4. During a telephone conversation with Damond Vadnais on 4/23/2003 a provisional election was made with traverse to prosecute the invention of Group I, claims 1-11, 26-37 and 52.

Affirmation of this election must be made by applicant in replying to this Office action. Claims

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12-25 and 38-51 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claim 3 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 3 recites, "the flow of the melt is chiefly caused by the rotation of the crucible". The term "chiefly" is indefinite. The term chiefly is unclear because dependent claims 5 and 6 claim a flow adjusting means is provided rotatably in the melt, which clearly would have an effect on the flow of the melt. Therefore it is unclear how much of an effect "chiefly" is required to have on the flow of the melt, when other factors, which affect the flow, are also claimed.

7. Claim 29 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 29 recites, "the flow of the melt is chiefly caused by the rotation of the supporting rack". The term "chiefly" is indefinite. The term chiefly is unclear because dependent claims 30 and 31 claim a flow adjusting means is provided rotatably in the melt, which clearly would have an effect on the flow of the melt. Therefore it is unclear how much of an effect

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"chiefly" is required to have on the flow of the melt, when other factors, which affect the flow of the melt, are also claimed.

Claim Rejections - 35 USC § 102

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

9. Claims 27-29, 33-35 and 52 are rejected under 35 U.S.C. 102(b) as being anticipated by O'Neill (US 4,243,472).

O'Neill discloses a method for liquid phase epitaxy of multiple wafers, note entire reference, comprising a crucible **14** filled with a melt material **16** to be epitaxially deposited on substrates (col 2, ln 15-35). O'Neill also discloses a substrate holder **10** and supporting a plurality of wafers **12** substantially horizontal and lowering and immersing the wafers into a melt to deposit a thin film on each wafer (col 1, ln 60-68) using a dipping rod member **18** connected at one end to a means for raising and lowering the substrate into the crucible (col 2, ln 36-67). O'Neill also discloses the substrate is disposed at a position set aside from the center of the crucible (Figs 2-4). O'Neill also discloses continually oscillating **30** the wafers through substantially 360°C (col 2, ln 1-2, col 4, ln 10-20 and Figs 2-4); this reads on applicant's rotation of the supporting rack.

Referring to claims 28 and 34, O'Neill discloses the substrates are arranged substantially horizontal, this reads on applicant's substantially parallel to the flow of the melt.

Referring to claim 29, O'Neill is silent to the flow of the melt is chiefly caused by the rotation of the supporting rack. This is inherent to O'Neill because O'Neill teaches a similar method of rotating the supporting rack, as applicant.

Referring to claim 33, O'Neill discloses raising and lowering the substrates into the crucible (col 2, ln 35-41).

Referring to claim 35, O'Neill discloses a group of substrates arranged keeping stated intervals one another in the direction which falls at right angles with the axis of the center of rotation of the supporting rack (Fig 1 and Fig 3).

Referring to claim 52, O'Neill discloses immersing the substrate in a substrate holder into a melt held in a crucible to grow a crystal by the liquid phase epitaxial method and the substrate holder is rotated.

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

11. Claims 36 and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over O'Neill (US 4,243,472).

O'Neill discloses all the limitation of claim 36, as discussed previously, except the plurality of groups independent from one another and all groups are immersed in the melt.

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O'Neill discloses a single substrate holder 10 for performing liquid phase epitaxy on a plurality of wafers 12. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify O'Neill by having a plurality of groups independent from one another by duplicating the single substrate holder 10 and immersing the holders into the melt to increase production. It is noted that the duplication of parts is held to be obvious (MPEP 2144.04 VI).

12. Claim 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over O'Neill (US 4,243,472) as applied to claims 27-29, 33-35 and 52 above, and further in view of Ukiyo et al (JP 11-199376), as English Abstract has been provided.

O'Neill discloses all of the limitations of claim 31, as discussed previously, except a flow adjusting means is provided rotably in the melt to make the flow of the melt inclined toward the center of rotation and/or the liquid surface of the melt.

In a liquid phase growing method, Ukiyo et al teaches melting a semiconductor and stirring structure independent of a substrate supporting stand and capable of carrying out the rotation and stirring independent of the supporting stand. Ukiyo et al also teaches the shape of a fin, this reads on applicant's flow adjusting means, for stirring is a twisted rectangular shape and the attaching angle thereof to the substrate supporting stand is 45° (Abstract and Fig 2). The shape of the fin, note Fig 2a, would inherently direct the melt toward the center of rotation. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify O'Neill with Ukiyo et al's flow adjusting means to provide a liquid phase growing

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method by which efficient and homogeneous liquid phase growth on a substrate is enabled (376 Abstract)

13. Claim 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over O'Neill (US 4,243,472) as applied to claims 27-29, 33-35 and 52 above, and further in view of Kokta et al (US 4,293,371)

O'Neill discloses all of the limitations of claim 32, as discussed previously, except supporting rack is rotated alternately in the clockwise and anticlockwise directions.

In a liquid phase epitaxial (LPE) method of growth, note entire reference, Kokta et al teaches the LPE technique is practiced under isothermal conditions and a common practice is to continuously rotate or oscillate the immersed wafer substrate in a plane parallel to the surface of the melt during growth in order to achieve essentially uniform growth over the wafer surface (col 1, ln 20-40). Kokta et al also teaches a heated substrate is rotated at 80 rpm (2 revolution clockwise, then 2 revolutions counter clockwise) (col 4, ln 10-35). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify O'Neill with Kokta et al's oscillating the substrate to improve the uniformity of growth over the wafer.

14. Claims 1-3, 7-11 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over O'Neill (US 4,243,472) in view of Kokune et al (US 5,603,762) or Admission.

O'Neill discloses a method for liquid phase epitaxy of multiple wafers, note entire reference, comprising a crucible 14 filled with a melt material 16 to be epitaxially deposited on substrates (col 2, ln 15-35). O'Neill also discloses a substrate holder 10 and supporting a

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plurality of wafers **12** substantially horizontal and lowering and immersing the wafers into a melt to deposit a thin film on each wafer (col 1, ln 60-68) using a dipping rod member **18** connected at one end to a means for raising and lowering the substrate into the crucible (col 2, ln 36-67). O'Neill also discloses the substrate is disposed at a position set aside from the center of the crucible (Figs 2-4).

O'Neill does not disclose the step of rotating the crucible independently from the substrate.

In a method of liquid phase epitaxy, note entire reference, Kokune et al teaches a melt is placed in a furnace and utilized for liquid phase epitaxial growth (col 5, ln 40-60). Kokune et al also teaches the melt held in a crucible is stirred by the rotation of the crucible and when a raw material for the melt is to be melted in the crucible, this mixture is placed in the crucible a stirring shaft is inserted downwardly into the crucible and the mixture is stirred by the shaft (col 6, ln 50 to col 7, ln 5). Kokune et al also teaches a crucible is fixed onto a table **13** and the table is rotated by a motor, so that the melt is stirred inside the crucible (col 7, ln 15-40). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify O'Neill with Kokune et al's rotation of the crucible to stir the melt, thereby improving the uniformity of the melt.

Admission teaches the rotation of crucible is applied in a liquid phase growth system. Admission also teaches the substrate is stationary and rotating only the crucible can make the substrate supporting means greatly simple and is advantageous for large sized liquid phase growth systems. Admission also teaches when the crucible is rotated the in-plane distribution of growth rate is good (pg 8). It would have been obvious to a person of ordinary skill in the art at

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the time of the invention to modify O'Neill with Admission because rotating the crucible improves the in-plane distribution of growth rate.

Referring to claim 2, the combination of O'Neill and Kokune or the combination of O'Neill and Admission teaches a substrate holder **10**, this reads on applicant's supporting rack, and the holder is disposed so that the wafers are held substantially horizontal, this reads on applicant's in the direction substantially parallel to the flow of the melt in the crucible.

Referring to claim 3, the combination of O'Neill and Kokune or the combination of O'Neill and Admission teach a rotation of the melt.

Referring to claim 7, the combination of O'Neill and Kokune or the combination of O'Neill and Admission teach raising and lowering the substrate holder ('472 col 2, ln 30-50).

Referring to claims 10-11, the combination of O'Neill and Kokune or the combination of O'Neill and Admission teaches all the limitations of claim 10, as discussed previously, except the plurality of groups independent from one another and all groups are immersed in the melt. The combination of O'Neill and Kokune or the combination of O'Neill and Admission discloses a single substrate holder **10** for performing liquid phase epitaxy on a plurality of wafers **12**. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of O'Neill and Kokune or the combination of O'Neill and Admission by having a plurality of groups independent from one another by duplicating the single substrate holder **10** and immersing the holders into the melt to increase production. It is noted that the duplication of parts is held to be obvious (MPEP 2144.04 VI).

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15. Claims 4 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over O'Neill (US 4,243,472) in view of Kokune et al (US 5,603,762) or Admission as applied to claims 1-3, 7-11 and 26 above, and further in view of Igarashi et al (JP 11-228250), an English abstract has been provided.

The combination of O'Neill and Kokune or the combination of O'Neill and Admission discloses all of the limitations of claim 4, as discussed previously, except a flow adjusting means is provided stationarily in the melt to make the flow of the melt inclined toward the center of rotation and/or the liquid surface of the melt.

In a method of crystal growth, Igarashi et al teaches a baffle plate 5 is attached to the inner peripheral surface of crucible 4, this reads on applicant's flow adjusting means provided stationarily in the melt, in a state inclined so that the upper side of the baffle plate become front side in the rotation direction of the crucible and then the crucible is rotated (Abstract). The inclined surface of the baffle plate, note Figs 2-3, inherently will direct the flow of the melt toward the center of rotation. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of O'Neill and Kokune or the combination of O'Neill and Admission with Igarashi et al's baffle plate attached to the crucible to remove suspended matter on the melt surface, thereby increasing purity ('280 Abstract).

16. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over O'Neill (US 4,243,472) in view of Kokune et al (US 5,603,762) or Admission as applied to claims 1-3, 7-11 and 26 above, and further in view of Ukiyo et al (JP 11-199376), as English Abstract has been provided.

The combination of O'Neill and Kokune or the combination of O'Neill and Admission discloses all of the limitations of claim 5, as discussed previously, except a flow adjusting means is provided rotably in the melt to make the flow of the melt inclined toward the center of rotation and/or the liquid surface of the melt.

In a liquid phase growing method, Ukiyo et al teaches melting a semiconductor and stirring structure independent of a substrate supporting stand and capable of carrying out the rotation and stirring independent of the supporting stand. Ukiyo et al also teaches the shape of a fin, this reads on applicant's flow adjusting means, for stirring is a twisted rectangular shape and the attaching angle thereof to the substrate supporting stand is 45° (Abstract and Fig 2). The shape of the fin, note Fig 2a, would inherently direct the melt toward the center of rotation. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of O'Neill and Kokune or the combination of O'Neill and Admission with Ukiyo et al's flow adjusting means to provide a liquid phase growing method by which efficient and homogeneous liquid phase growth on a substrate is enabled (' 376 Abstract)

17. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over O'Neill (US 4,243,472) in view of Kokune et al (US 5,603,762) or Admission as applied to claims 1-3, 7-11 and 26 above, and further in view of Burkhart et al (US 5,902,394).

The combination of O'Neill and Kokune or the combination of O'Neill and Admission discloses all of the limitations of claim 6, as discussed previously, except the crucible is rotated alternately in the clockwise and anticlockwise directions.

In a method of oscillating a crucible rotation, note entire reference, Burkhardt et al teaches a mechanism capable of rotating a crucible at various rates of rotation and varying the rates of rotation during a given period such that particles contained in the melt are reduced (col 2, ln 5-45). Burkhardt et al also teaches the rate of rotation is controlled to alternate between a forward rate of rotation (clockwise) and a reverse rate of rotation (counter clockwise) (col 4, ln 55-67). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of O'Neill and Kokune or the combination of O'Neill and Admission with Burkhardt et al's oscillating crucible rotation between clockwise and counter clockwise rotation to reduce particles in a melt, thereby improving the quality of the crystal produced.

Conclusion

18. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

O'Neill (US 4,191,365) teaches a horizontal substrate holder for liquid phase epitaxy, note entire reference.

Iwane et al (US 2002/0108559) is a publication of application 10/022,545 to applicant, which teaches similar features as claimed, note entire reference.

19. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J Song whose telephone number is 703-305-4953. The examiner can normally be reached on M-F 9:00-5:00.


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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin L Utech can be reached on 703-308-3868. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

Matthew J Song
Examiner
Art Unit 1765

MJS
April 29, 2003


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SUPERVISORY PATENT EXAMINER
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